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(71) Applicant

Peter James Harrold
The Old White Horse, Richmond Road, Saham Toney,
Thetford, Norfolk, IP25 7ET

(72) Inventor

Peter James Harrold

(74) Agent and/or Address for Service

T I P Dummett & Co
14 The Square, Martlesham Heath, Ipswich,
Suffolk, IP5 7SL

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Selected US specifications from IPC sub-classes
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(54) Modular electronic vehicle-management system

(57) A modular system for providing vehicle electronic functions has a first module 10 with a central processing unit, one or more second modules 12 connected to the first module and normally a third module with a display. Each second module has first and second connectors 16 linked by straight-through conductor paths in the module to provide daisy-chaining of various modules, and each second module also includes a functional circuit such as a reversing meter, a burglar alarm unit or an MPG/trip meter.

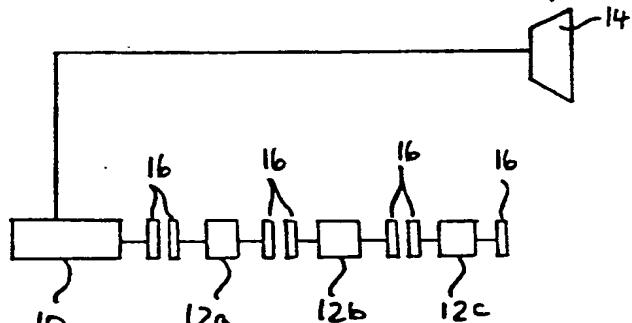


Fig. 1

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The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

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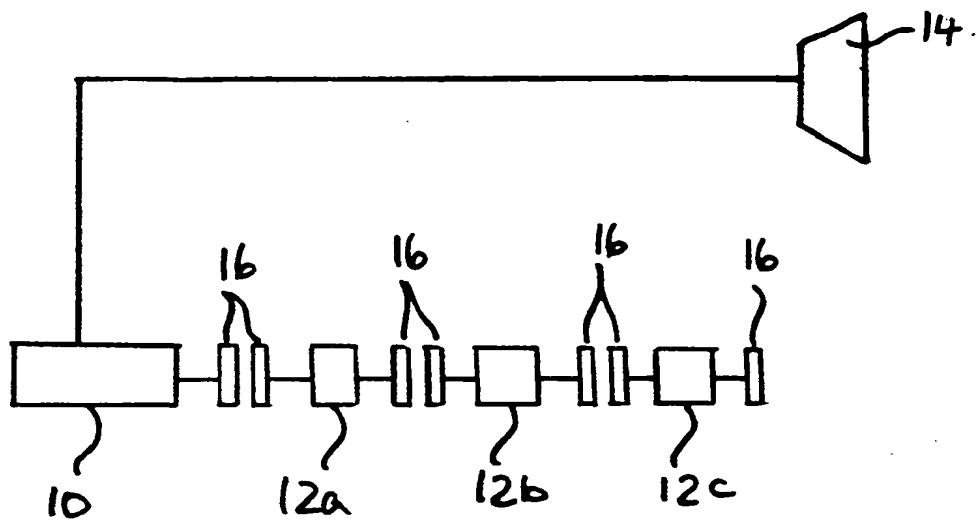


Fig. 1

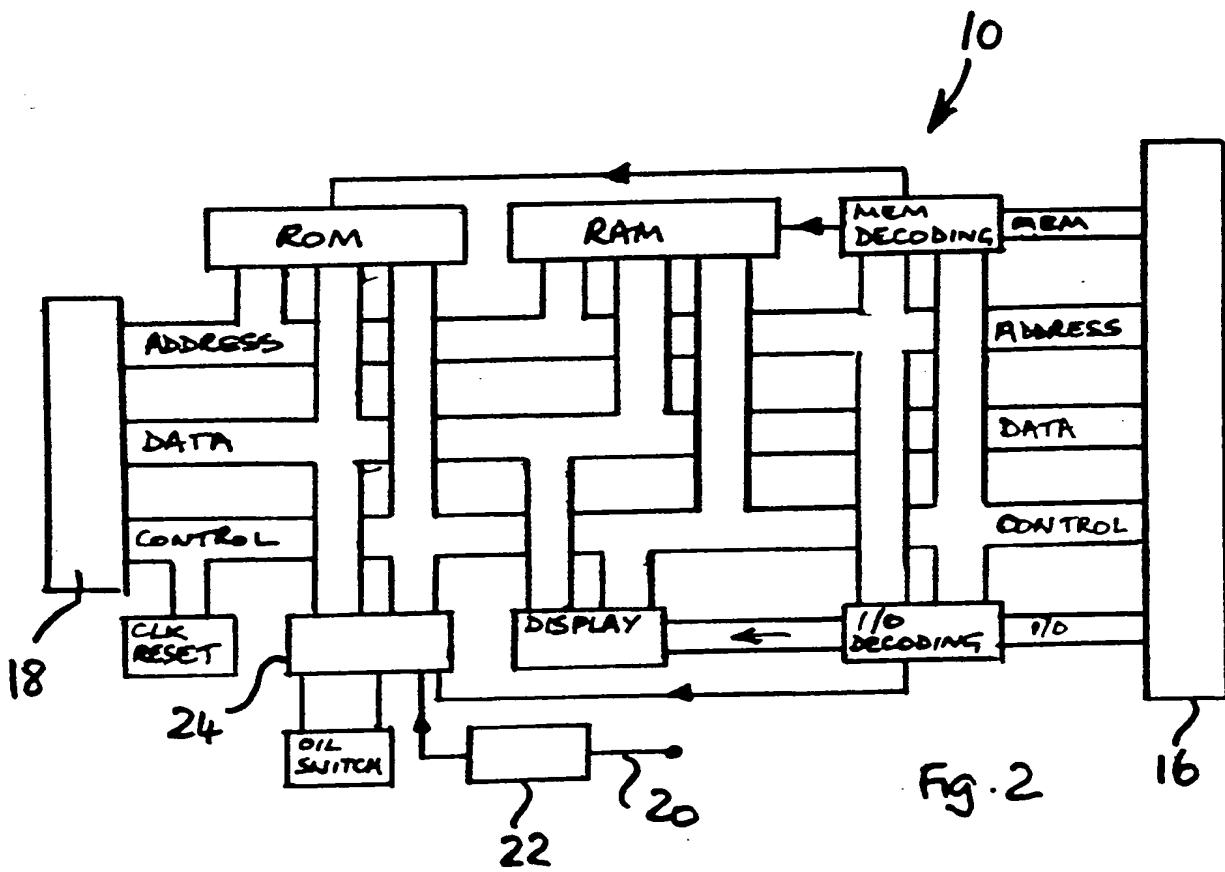


Fig. 2

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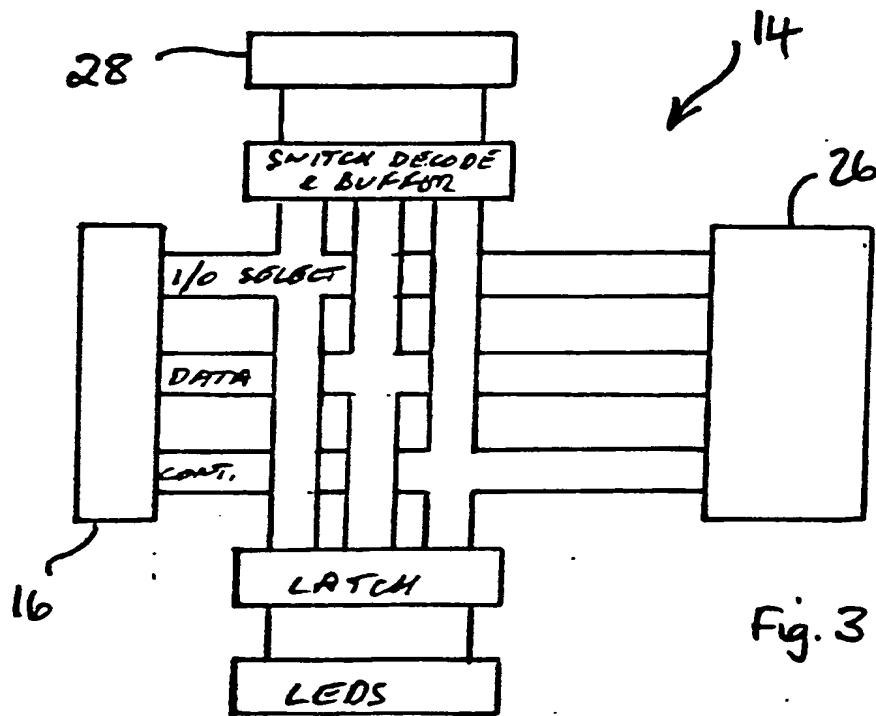


Fig. 3

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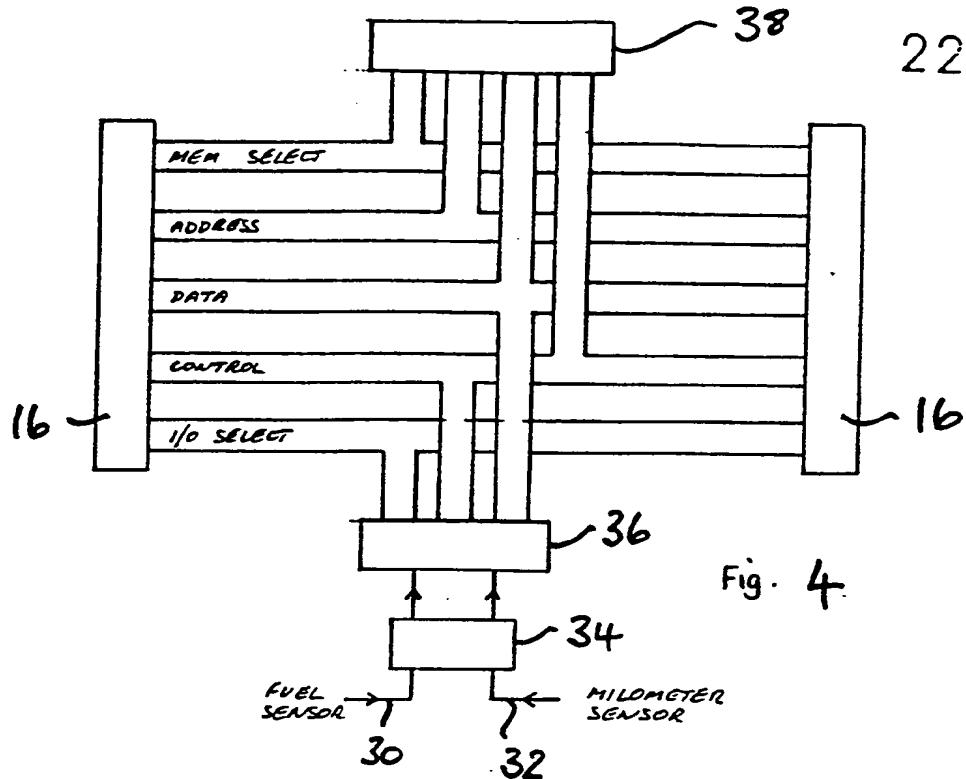


Fig. 4

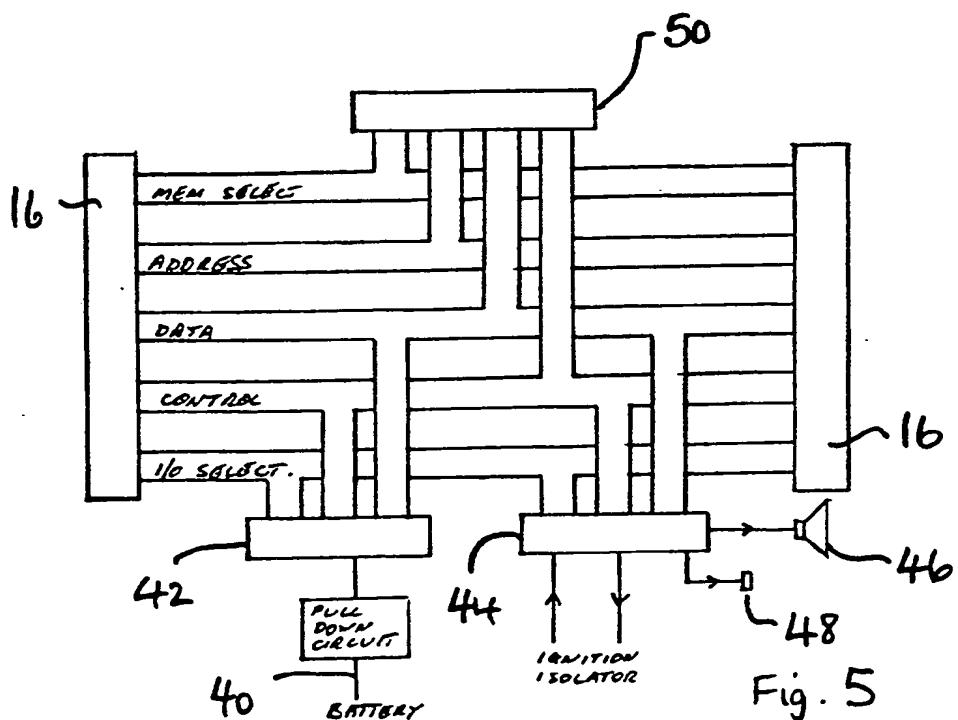
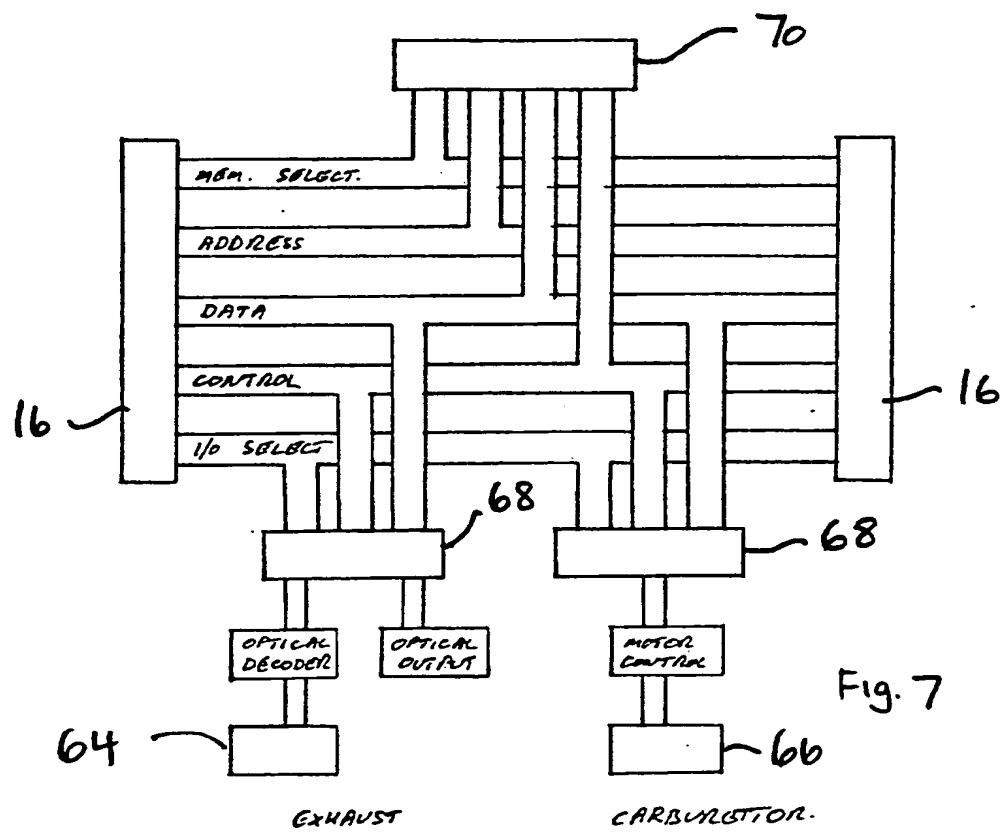
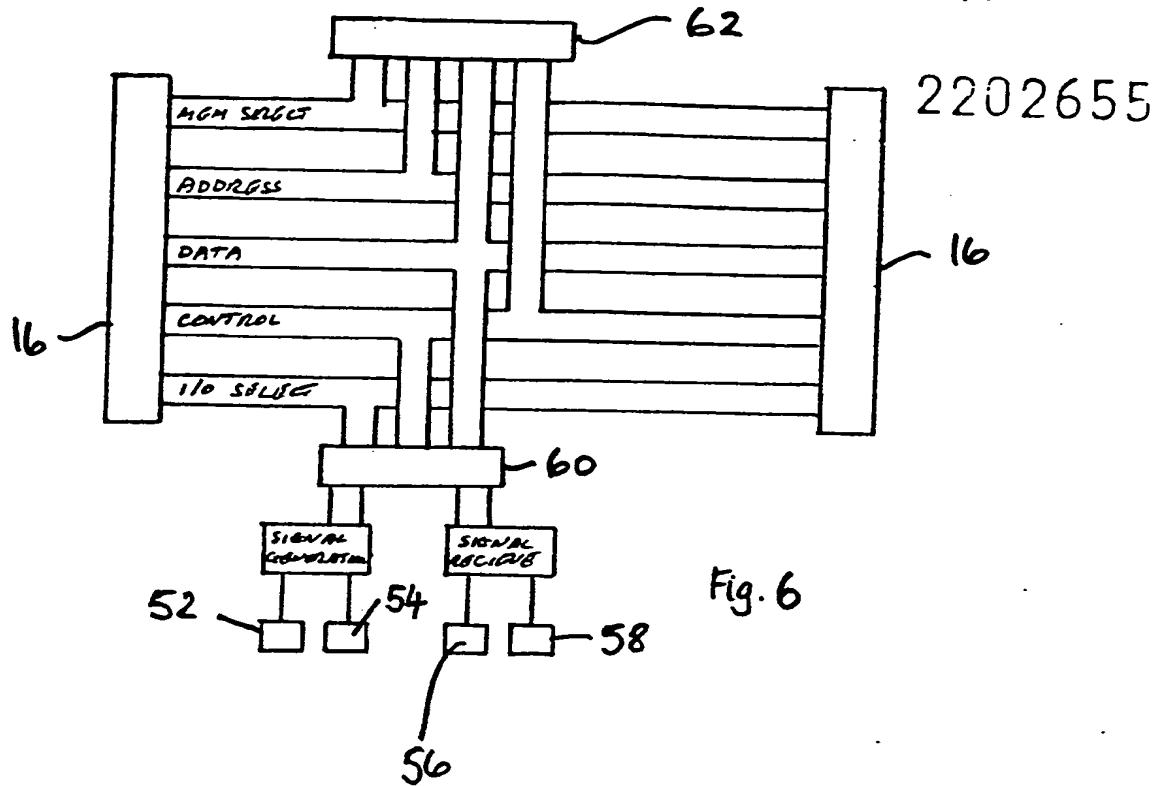


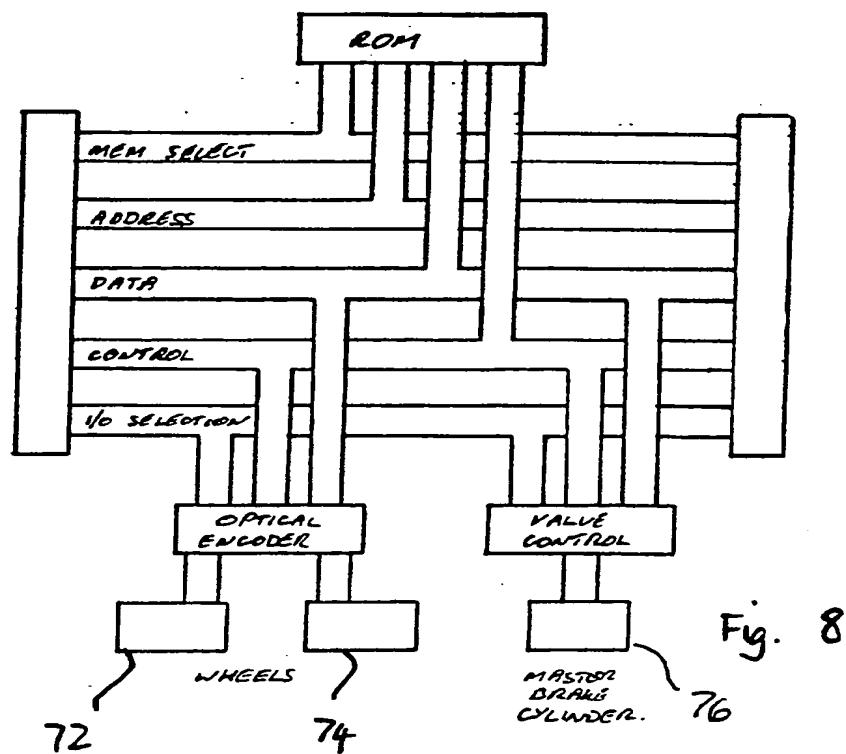
Fig. 5

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TITLE: Electronic Vehicle Management Equipment

This invention relates to electronic vehicle management equipment and in particular, but not exclusively, to such equipment which can be fitted as an accessory to an existing vehicle. The equipment is not however limited to this "aftermarket" application but may also find application in the construction of new vehicles.

The term "vehicle management equipment" encompasses units or modules which contribute to the efficient running of the vehicle, such as feedback controls which aim to optimise engine combustion conditions, as well as units or modules which are accessories such as a burglar alarm or a trip computer.

Vehicle accessories and instruments are often required to be fitted in various different combinations. For example in new vehicles, a particular trim level may attract a certain range of instruments, whereas a higher trim level may attract a greater range of instruments. Similarly, with retro-fitted accessories, a purchaser may require certain accessories, or a certain combination of accessories but not others.

According to the present invention, there is provided electronic vehicle management equipment comprising a plurality of mutually interconnectable modules, a first module including a central processing unit, and a second module connected to the first module and having first and second connectors for connection to external connection points, the connectors being joined by

straight through conductor paths in the module, the module also including a read only memory and a functional circuit and means for inputting vehicle management signals to the circuit, whereby information collected by the functional circuit of the second module is processed by the central processing unit.

There may be a third module which includes a screen and a connector for connection either to the first or to a second module, so that information processed by the central processing unit is shown on the display.

There may be a number of "second" modules, each having a different functional circuit in accordance with its intended function. All the second modules can be connected together in series in a "daisy-chain" fashion with a second module at one end of the chain connected to the first module. In this way each second module can have access to the CPU and to the display independently of the other second modules.

Each second module however preferably has its own read only memory.

A selection arrangement is preferably provided by which the functional circuit of any particular second module can be selected such that a reading from this module is displayed.

The second modules can have a timesharing relationship with the central processing unit of the first module. The CPU will sample all connected second modules periodically to determine which have been put into operation.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

5 Figure 1 is a schematic diagram of an electronic vehicle management arrangement in accordance with the invention;

Figure 2 is a block diagram of a first module;

10 Figure 3 is a block diagram of a third module; and

Figures 4, 5, 6, 7 and 8 are block diagrams of alternative second modules.

15 Figure 1 shows schematically a chain of modules making up an electronic vehicle management installation. The installation shown comprises a first module 10, three second modules 12a, 12b and 12c and one third module 14. Each module has a connector 16, and these connectors are intended to be directly plugged into one another. Either a greater or a lesser number of second modules 12 could be included between the first and third modules and a useable system can also be constructed by including in the first or third modules one basic "second" module which will be required in all installations.

30 Figure 2 shows the first module 10. The basic component of this module is a CPU 18 of appropriate capacity and function. This can be an 8-bit chip with a working RAM of 2k. The module shown in the Figure also includes a rev counter for counting the revolutions of the engine, and this rev counter forms a functional circuit for producing a particular output to the display.

The module has a connector 16 (this may be male or female) and internal circuitry as shown. There is an external connection 20 to the ignition coil of the vehicle, and a signal from the coil is fed through a flip flop 22 to a buffer 24. There is a data input from a preset switch inside the module. As the coil produces regular 12 volt pulses, one for each ignition spark produced, the module simply reduces this into a manageable signal which it then passes into the flip flop gate 22 and the buffer 24. By checking the state of this buffer, keeping an exact note of the time delay between each spark and the number of cylinders in use, it is possible to calculate the number of revolutions the engine is producing.

Figure 3 shows the third module 14. This module has a connector 16 (of gender opposite to that of the connector 16 on the module 10) and a display 26. The display itself can be of any suitable type. The module also includes a selector unit 28 by means of which the operator can select a particular function from amongst those available to him in any particular installation.

Figure 4 shows a fuel consumption and trip meter module which can be connected between the first module 10 and the third module 14. This module has connectors 16 at either end and it will be noted that all the communication lines from the input and output connectors 16 are straight through, and this allows a number of these second modules to be connected together in series and each to be independently operable as desired. This fuel consumption/trip meter has two sensors. The first is fitted on the fuel line 30 and

produces a regular pulse for a known amount of fuel passing through it. The second sensor is fitted to the milometer cable 32 and produces a pulse for a known amount of distance travelled. By passing these pulses through a flip flop 34 and a buffer 36, it is possible to make calculations for miles per gallon used, miles per hour, distance travelled etc. A dedicated ROM 38 contains the necessary instructions.

10 Figure 5 shows a burglar alarm module. This module takes an input 40 from the vehicle battery which is passed through an analogue to digital convertor 42. The data from the convertor is monitored by the system and any significant drop in power (caused for example
15 by the interior light activating or the ignition circuit being turned on) will activate the system. Output of the alarm is passed through a voltage isolator 44 to enable the horn 46 and/or the lights 48.

20 This module can be enabled via the selection unit 28 on the module 14 and can be disabled by a preset code also entered through the selection unit, by the driver. This burglar alarm unit likewise has a dedicated ROM 50
25 containing the necessary programme instructions.

Figure 6 illustrates a distance sensing module for use when reversing. This module is effective to provide an indication of the distance between the rear of the vehicle and an external object when reverse gear has been selected. The module produces two different frequency ultrasonic outputs from transducers 52 and 54 fitted at the rear of the vehicle. To eliminate false feed back, these signals are produced in pulse form
35 under control of the system. Two corresponding input

transducers 56 and 58 are located adjacent to the outputs 52, 54 and the different frequencies help to eliminate crossover between the two sets.

5 The system notes the time delay between the output of the signal and return bounce from any object it encounters. As the speed of the ultrasonic signal is a virtual constant, it is possible for the system to calculate the distance between the rear of the vehicle
10 and objects in its path. The signals are produced and received through a buffer 60, and a dedicated ROM 62 contains the programme instructions for this module.

Figure 8 shows a module dedicated to optimisation of
15 engine performance and economy. The module works on the principal of fine tuning the fuel and air to its optimum combustion ratio to achieve maximum engine performance and economy. An optical sensor 64 monitors the exhaust gas for fuel and gas deposits exiting from
20 the engine. This data is compared to internal information on optimum output, the system calculating whether the mixture requires more or less fuel to reach the optimum ratio. Adjustments are then made on the carburettor mixture valve through a small degree
25 stepper motor 66 which allows minute adjustments to be made until the optimum ratio is reached. The control is therefore a feed back control. The sensing process is repeated at a rate of approximately 100 cycles per second. This makes it possible for the engine to be
30 continuously fine tuned throughout its operating range.

Upon the ignition being turned off, the unit returns
35 the stepper motor to a preset position (normally set slightly rich) to allow for easy restarting.

A time delay activated by the choke (not shown) allows for starting problems in cold weather.

5 The optical input 64 for the exhaust sensor may allow collection of additional information such as high oil or water content in the exhaust, to be passed to the driver. The input sensor 64 can be an infra-red sensor.

10 As with the other modules, there are buffers 68 between the data inputs and the dedicated ROM 70 which carries the processing instructions.

15 Figure 8 shows a module forming an anti lock brake unit. This unit has two main parts; a pair of optical sensors 72 and 74 set on independent wheels and a powered hydraulic valve 76 which is located on the main brake line. The sensors 72 and 74 are used to check for rotation of the wheels, the output from these sensors being monitored by the system. As long as there is rotation of the wheels then the hydraulic valve acts in a passive mode allowing the master brake cylinder to function in its normal manner.

25 If the wheels should lock, then the optical sensors activate the hydraulic valve into operation, cutting off pressure from the master cylinder and drawing off a small amount of fluid from the brake system. This releases some of the power to the brakes, allowing the wheels to rotate again. Once rotation commences, the valve is returned to its passive mode, reinjecting the drawn-off fluid and returning control to the master cylinder.

This process is repeated so long as the unit is active, at a rate of approximately 30 cycles per second. The amount of fluid drawn off is determined by the system, being dependent on the amount required to release the
5 brakes.

As the system uses two independent wheels as sensors, problems such as a locked wheel are overcome.

10 In Figures 4 to 8, the modules are shown each with its own individual dedicated read only memory. It may however be possible for the programming for each of these modules to be contained in a read only memory in the first module 10.

15 In use, each of the second modules or peripherals 12 has a "time sharing" relationship to the first module 10. The first module which forms a control unit acts as manager under control of the selected peripheral
20 unit and distributes the relevant data, control and power lines. When an option is selected on the selection unit 28, the internal memory determines the relevant programme address and circuitry required to perform this function, ie

25 pressing option 1 enables address 100
 pressing option 2 enables address 200
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 pressing option 8 enables address 800

The control unit 12 then checks that the peripheral

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required is available, and memory control is passed to this unit to carry out its function. This assumes that the peripheral concerned has its own integral ROM.

- 5 If the peripheral requested is not available the system indicates this on the selection panel and returns to performing its last function.

10 The selection unit 28 incorporates a switch grid to enable option selection and input of data, a display grid to indicate active option and a numerical display for data output. It has interrupt facilities to the control unit 10, thus allowing reselection without constant scanning of the selection unit. The connector
15 16 on the main control unit allows interaction of all necessary communication lines. As shown, memory decoding and input/output decoding is catered for by a RAM in the control unit 10 and this keeps circuitry for each peripheral to a minimum. It would however be
20 possible for additional RAM capacity to be provided in particular peripherals, where the operation of those peripherals requires more RAM than is available in the control unit 10.

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CLAIMS

1. Electronic vehicle management equipment comprising a plurality of mutually interconnectable modules, a
5 first module including a central processing unit, and a second module connected to the first module and having first and second connectors for connection to external connection points, the connectors being joined by straight through conductor paths in the module, the
10 module also including a read only memory and a functional circuit and means for inputting vehicle management signals to the circuit, whereby information collected by the functional circuit of the second module is processed by the central processing unit.
- 15 2. Equipment as claimed in Claim 1, including a third module which includes a screen and a connector for connection either to the first or to a second module, so that information processed by the central processing
20 unit is shown on the display.
- 25 3. Equipment as claimed in Claim 1 or Claim 2, comprising a plurality of second modules, each having a different functional circuit.
- 30 4. Equipment as claimed in Claim 3, wherein all the second modules are connected together in series in a "daisy chain" fashion with a second module at one end of the chain connected to the first module.
- 35 5. Equipment as claimed in any preceding claim, wherein each second module has its own read only memory.

6. Equipment as claimed in any preceding claim, including means for selecting the functional circuit of one particular second module such that a reading from this module alone is displayed.

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7. Equipment as claimed in any preceding claim, wherein the second modules have a time sharing relationship with the central processing unit of the first module.

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8. Electronic vehicle management equipment substantially as herein described with reference to the accompanying drawings.

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